PATENT ABSTRACTS OF JAPAN

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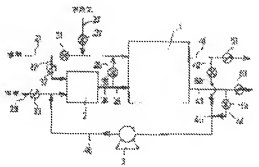
(54) INTERNAL REFORMING TYPE FUSED CARBONATE FUEL CELL AND OPERATION THEREOF

(57)Abstract:

PURPOSE: To facilitate heating at the starting time of an internal reforming type fused carbonate fuel cell and independently generate electric power.

CONSTITUTION: After at least a part of fuel is burned by a catalytic burner 2 to consume the oxygen in the air, this combustion gas is supplied to both the anode and cathode sides of an internal reforming type fused carbonate fuel cell 1 to heat the fuel cell 1 to a prescribed temperature. A power generation device can be made in a form of package as an independent power source without using heating by a special method from the outside, so that it is possible to easily operate the internal reforming type fused carbonate fuel cell 1 at an isolated island or a place where there is no existing power generation equipment.



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CLAIMS

[Claim(s)]
[Claim 1]An internal refining type fused carbonate fuel cell comprising:
A main part of an internal refining type fused carbonate fuel cell which has a reforming catalyst in the anode side.
A means to mix and to burn use fuel and air at the time of a power generation start.
A means to supply heating gas after combustion to the anode and/or cathode side.

[Claim 2]A means to flow back to the means [to mix use fuel and air and to burn this a part of heating gas discharged from a main part of an internal refining type fused carbonate fuel cell at the time of this power generation start] side, An internal refining type fused carbonate fuel cell having further a means to supervise battery temperature and to control fuel and the amount of air supply, and an exhaust gas amount.
[Claim 3]It is an operating method of an internal refining type fused carbonate fuel cell which generates electricity by supplying a fuel cell directly without reforming fuel which does not contain hydrogen, such as methane or natural gas, An operating method of an internal refining type fused carbonate fuel cell heating a fuel cell body to a temperature suitable for operation by supplying heating gas after this combustion to the anode and/or cathode side after burning this fuel and air and consuming oxygen in the air at the time of a power generation start.
[Claim 4]Supervise battery temperature, and control fuel and the amount of air supply, and an exhaust gas amount based on the value, and. An operating method of the internal refining type fused carbonate fuel cell according to claim 3 which has further flowing back to the means [to mix use fuel and air and to burn this a part of heating gas discharged from a cell proper at the time of this power generation start] side.
[Claim 5]An operating method of the internal refining type fused carbonate fuel cell according to claim 3 or 4 performing fuel with these some fuel and air under an air content smaller than

an air content required for oxidation reaction of this fuel.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to an internal refining type fused carbonate fuel cell and an operating method for the same, and relates to an internal refining type fused carbonate fuel cell which made it possible to heat the cell proper at the time of the start up of this fuel cell easily especially, and an operating method for the same.
[0002]
[Description of the Prior Art]In order to use the melt of carbonate for a fused carbonate fuel cell as an electrolyte, generally the operating temperature of the cell is used at the temperature near 650 **. At the time of power generation, if it is possible to maintain this temperature and it is in actual operation, in order to maintain battery temperature near 650 **, to cool a cell is also needed by a cell's own generation of heat.
[0003]On the other hand, at the time of a power generation start, i.e., cell starting, It is necessary to heat a cell proper near 650 ** and to the temperature which carbonate ion can move at least, and as a heating method for it in an external refining type fused carbonate fuel cell. The method of supplying a reformer, i.e., the reforming gas from a reformer, to a cell proper, and heating it or the method of being given only at the time of starting and heating an external power with an electric heater is generally performed.
[0004]As a temperature-up means at the time of the start up in an external refining type fused carbonate fuel cell, At the time of the start up of a fuel cell body, burning mixed gas with the oxidant gas which carried out specified quantity content of the fuel gas containing hydrogen and the oxygen, and carrying out temperature up by introducing the obtained high temperature gas in a fuel cell body is also known (refer to JP,59-98471,A).
[0005]
[Problem(s) to be Solved by the Invention]Generally, when heating with reforming gas or an

electric heater, it is very difficult to attain equalization of the temperature distribution produced in a cell proper. For example, since only the anode side must be supplied when using reforming gas, a temperature gradient arises between the cathode sides, distortion occurs in a cell and the problem of damaging an electrolyte plate is arising. When heating with an electric heater, since it is substantially difficult, a big temperature gradient arises and installing a heater for every cell has a possibility that the same phenomenon may appear remarkably with large-scale-izing of a cell in the distant place near the heater.

[0006]By the way, carry out direct supply of the hydrocarbon gas, such as methane and natural gas, to the anode side of a fuel cell, and reform to hydeogen-rich gas using a catalyst inside a cell, and. If it is in the fuel cell using the mixed gas of air and carbon dioxide as an oxidizer, and what is called an internal refining type fused carbonate fuel cell, using melting carbonate as an electrolyte, In order to perform refining of fuel, i.e., refining to hydrogen, inside a cell proper, it does not have a reformer like an external refining type fused carbonate fuel cell. Therefore, it is a thing which heat a cell proper by the reforming gas from a reformer and for which the things itself cannot be carried out, Getting the electrical and electric equipment from an external power on the other hand, and heating with a heater is generally performed, and **. Since it described above, the heating by an electric heater cannot necessarily say it as sufficient thing. When using it at the place which furthermore does not have an external power, for example, a detached island, as an independent source, the method heating with an electric heater itself is impossible, and simple [for the preheating at the time of the power generation start of an internal refining type fused carbonate fuel cell] and positive has been called for.

[0007]Although the means started by above-mentioned JP,59-98471,A is effective as a temperature-up means of the fuel cell using the fuel containing hydrogen, i.e., an external reforming fuel cell, Since the fuel which is used in the case of an internal refining type fuel cell does not have a hydrogen constituent as described above, the above-mentioned means cannot be used as a heating method of the fuel cell of internal refining type melting carbonate as it is.

[0008]An object of this invention is to indicate an internal refining type fused carbonate fuel cell from which the problem of the conventional technology produced at the time of starting of the above-mentioned fuel cell was removed, and an operating method for the same, and it enables this to obtain an internal reforming fuel cell usable as an independent source. That is, temperature distribution in a cell can be lessened, an internal reforming fuel cell can be heated easily even in a place without a detached island or other power supplies, and this invention enables it to generate electricity by supplying fuel and an oxidizer after heating.

[0009]

[Means for Solving the Problem]A main part of an internal refining type fused carbonate fuel cell which has a reforming catalyst in the anode side in order that this invention may attain the

above-mentioned purpose, A means to mix and to burn a part and air of use fuel at the time of a power generation start, and a means to supply heating gas after combustion to the anode and/or cathode side are provided, and an internal refining type fused carbonate fuel cell characterized by things is indicated.

[0010]It becomes possible to attain the purpose more by providing further a means refluxed to the means [to mix use fuel and air and to burn this a part of heating gas discharged from a cell proper] side, and a means to supervise battery temperature and to control fuel and the amount of air supply, and an exhaust gas amount inside. This invention is an operating method of an internal refining type fused carbonate fuel cell which generates electricity by supplying a fuel cell directly without reforming further fuel which does not contain hydrogen, such as methane or natural gas, After burning a part and air of this fuel and consuming oxygen in the air at the time of a power generation start, by supplying heating gas after this combustion to the anode and/or cathode side, An operating method of an internal refining type fused carbonate fuel cell heating a fuel cell body to a temperature suitable for operation is also indicated.

[0011]Mode ***** with making it reflux this a part of heating gas discharged from a cell proper to the means [to mix and to burn use fuel and air] side, and more preferred performing fuel with some fuel and air further under an air content smaller than an air content required for oxidation reaction of this fuel.

[0012]

[Function]That is, this invention is mixed with air, burns some fuel, supplies the gas which became high [temperature] to the anode and/or cathode side, makes temperature distribution in a cell uniform, and heats a cell. In this invention, oxygen in the air in the mixed gas of fuel gas and air is altogether consumed in oxidation reaction of fuel.

Therefore, an anode is not oxidized even if it supplies the anode side.

Although it is natural, since refining of the fuel is not carried out, it does not return a cathode.

[0013]It does not interfere, even if combustion of fuel and air may be performed using a combustion furnace and it uses a catalytic combustion device. If it is when recycling and using heating gas, improvement in heating efficiency is expectable. It can heat on condition of hope easily by detecting battery temperature at this time and controlling the amount of recycle gas, fuel, air, and an exhaust gas amount by temperature.

[0014]

[Example]Hereafter, this invention is explained more to details based on explanation of the example which referred to drawings. Drawing 1 is a lineblock diagram showing only the portion concerning heating of the cell proper at the time of the power generation start of the internal refining type fused carbonate fuel cell by this invention in block diagram. In a figure, 1 is a main part of an internal refining type fused carbonate fuel cell which has a reforming catalyst in the

anode side. what was conventionally known in this invention can be used as it is, and detailed explanation about a cell proper is not given.

[0015]The piping 21 for a fuel gas feed port has connected with a cell proper. This piping 21 had the branch pipe 22, and has connected this branch pipe 22 to the catalytic combustion device 2 which adjoined the cell proper 1 and was provided via the flow control valve 32. The piping 23 for introducing air further has connected with the catalytic combustion device 2 via the flow control valve 33, and it has the piping 24 in the combustion-gas-exhaust side. This piping 24 branches to two forks, and connects one branch pipe 25 to the piping 21 for fuel supply via the flow control valve 35, and the branch pipe 26 of another side is opening it for free passage to the oxidizer feed port side of a cell proper.

The valve 31 is formed in the tee lower stream of the branch pipe 22 in the piping 21 for fuel supply, and the piping 27 for supplying the steam for performing refining of the fuel within a cell proper smoothly downstream further has connected via the valve 37.

[0016]In this example, the branch pipes 42 and 44 are formed, respectively from the anode side discharge piping 41 provided in the gas discharge side of the cell proper 1, and the cathode side discharge piping 43, the biparite branched pipes 42 and 44 are carried out unification 45, and serve as the pipeline 46, and the connection opening is carried out to the air introduction pipe 23. The flow control valves 51 and 53 are formed in the downstream from the tee of the branch pipe of each discharge piping, respectively, and the valve 52 is formed in the branch pipe 42. The recycling blower 3 is formed in the proper part in the channel at the pipeline 46, and it acts so that the gas in a pipeline may be flowed back to the upstream 33, i.e., air introduction pipe, side.

[0017]At the time of the power generation start, the internal refining type fused carbonate fuel cell by this invention which has such composition is operated as follows. The valve 31 provided in the piping 21 for fuel supply is closed, the flow control valves 32 and 33 are adjusted, the air of the piping 21 side for fuel supply to the specified quantity is introduced from the piping 23 for air introduction, respectively, and the fuel gas of the specified quantity of the natural gas which uses methane as the main ingredients is made to flow in the catalytic combustion device 2. Stirring mixing is carried out within the catalytic combustion device 2, and the fuel and air which flowed burn. Since there is a possibility of containing an oxygen component at the beginning of combustion, about the combustion gas produced by this combustion, the valve 35 is closed and it introduces into the cathode side first, and the valve 35 is opened after fixed time lapse, and the anode side is also supplied. By supply of this combustion gas, a fuel cell body is heated equally, without that whole having an exceptional temperature gradient. Therefore, it can heat even to prescribed temperature even at about 650 **, for example, without being accompanied by inconvenience, such as damage to the apparatus by partial thermal expansion etc.

[0018]When a cell proper is heated by even predetermined temperature, the valve 31 is opened, and the operation of a catalytic combustion device is suspended, and it switches to the usual operational status of an internal reforming fuel cell. Since subsequent operational status is completely the same as the operational status in a publicly known internal reforming fuel cell conventionally, explanation is omitted. Although the combustion gas supplied to the fuel cell body is discharged from the piping 41 and 43 for discharge by the side of an anode and a cathode, respectively, those main ingredients of this emission gas are remains methane, carbon dioxide, carbon monoxide, a steam, and nitrogen.
It has a considerable amount of quantity of heat.
Therefore, a cell proper can be more efficiently heated by returning to the upstream again and reusing this emission gas.
[0019]In that case, the flow control valves 51 and 53 provided in the piping 41 and 43 for discharge are adjusted, The valves 52 and 54 provided in each branch pipe 42 and 44 are opened, emission gas is sent into the recycling blower 3 via the pipeline 46, and it returns into the piping 23 for air supply by operation of this Blois at the same time it restricts an exhaust gas amount. It mixes with the air introduced and the returned recycling exhaust gas flows in the catalytic combustion device 2. Within the catalytic combustion device 2, it mixes with the fuel introduced separately and combustion arises.
[0020]Although such control in particular is not illustrated, a piece or two or more temperature detecting means are installed in the predetermined part of a cell proper. The information from there is supervised and it is very effective to carry out according to this information fuel and the amount of air supply, the discharge of heating gas, and by controlling the flow of the above-mentioned flowing-back gas, etc. suitably further. In the case where it carries out with the case where exhaust gas is not flowed back, in the experiment conducted to the same cell proper, the heating rate was 15 ** [h] /and about 30 **/h, respectively, and the time required heating to 650 ** was 44 hours and 22 hours.
[0021]By controlling the quantity of the fuel to introduce and air by this invention suitably, There is nothing that is made to consume all oxygen in the air by oxidation reaction in combustion within a burner and that oxidize an anode even if things can be carried out and it supplies combustion gas to the anode side, and the fuel to be used is also the fuel by which refining is not carried out.
Therefore, it becomes possible to operate without being able to ensure [easily] heating before power generation of a publicly known internal refining type fused carbonate fuel cell conventionally, and making a cell proper also produce what inconvenience from not oxidizing a cathode.

[0022]Although explanation of the above-mentioned example explained what used the catalytic

combustion device as a burner, this is only mere illustration and it will be understood easily that arbitrary burners, such as a combustion furnace, can be used similarly.

[0023]

[Effect of the Invention]According to this invention, an internal refining type fused carbonate fuel cell can be easily heated to power generation start temperature. Even place [which does not have external powers, such as a detached island, as an independent source], a cell can be started easily.

[Translation done.]

TECHNICAL FIELD

[Industrial Application]This invention relates to an internal refining type fused carbonate fuel cell and an operating method for the same, and relates to an internal refining type fused carbonate fuel cell which made it possible to heat the cell proper at the time of the start up of this fuel cell easily especially, and an operating method for the same.

[Translation done.]

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PRIOR ART

[Description of the Prior Art]In order to use the melt of carbonate for a fused carbonate fuel cell as an electrolyte, generally the operating temperature of the cell is used at the temperature near 650 **. At the time of power generation, if it is possible to maintain this temperature and it is in actual operation, in order to maintain battery temperature near 650 **, to cool a cell is also needed by a cell's own generation of heat.
[0003]On the other hand, at the time of a power generation start, i.e., cell starting, it is necessary to heat a cell proper near 650 ** and to the temperature which carbonate ion can move at least, and as a heating method for it in an external refining type fused carbonate fuel cell, The method of supplying a reformer, i.e., the reforming gas from a reformer, to a cell proper, and heating it or the method of being given only at the time of starting and heating an external power with an electric heater is generally performed.
[0004]As a temperature-up means at the time of the start up in an external refining type fused carbonate fuel cell, At the time of the start up of a fuel cell body, burning mixed gas with the oxidant gas which carried out specified quantity content of the fuel gas containing hydrogen and the oxygen, and carrying out temperature up by introducing the obtained high temperature gas in a fuel cell body is also known (refer to JP,59-98471,A).

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EFFECT OF THE INVENTION

[Effect of the Invention]According to this invention, an internal refining type fused carbonate fuel cell can be easily heated to power generation start temperature. Even place [which does not have external powers, such as a detached island, as an independent source], a cell can be started easily.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]Generally, when heating with reforming gas or an electric heater, it is very difficult to attain equalization of the temperature distribution produced in a cell proper. For example, since only the anode side must be supplied when using reforming gas, a temperature gradient arises between the cathode sides, distortion occurs in a cell and the problem of damaging an electrolyte plate is arising. When heating with an electric heater, since it is substantially difficult, a big temperature gradient arises and installing a heater for every cell has a possibility that the same phenomenon may appear remarkably with large-scale-izing of a cell in the distant place near the heater.
[0006]By the way, carry out direct supply of the hydrocarbon gas, such as methane and natural gas, to the anode side of a fuel cell, and reform to hydeogen-rich gas using a catalyst inside a cell, and. If it is in the fuel cell using the mixed gas of air and carbon dioxide as an oxidizer, and what is called an internal refining type fused carbonate fuel cell, using melting carbonate as an electrolyte, In order to perform refining of fuel, i.e., refining to hydrogen, inside a cell proper, it does not have a reformer like an external refining type fused carbonate fuel cell. Therefore, it is a thing which heat a cell proper by the reforming gas from a reformer and for which the things itself cannot be carried out, Getting the electrical and electric equipment from an external power on the other hand, and heating with a heater is generally performed, and **. Since it described above, the heating by an electric heater cannot necessarily say it as sufficient thing, When using it at the place which furthermore does not have an external power, for example, a detached island, as an independent source, the method heating with an electric heater itself is impossible, and simple [for the preheating at the time of the power generation start of an internal refining type fused carbonate fuel cell] and positive has been called for.
[0007]Although the means started by above-mentioned JP,59-98471,A is effective as a temperature-up means of the fuel cell using the fuel containing hydrogen, i.e., an external reforming fuel cell, Since the fuel which is used in the case of an internal refining type fuel cell

does not have a hydrogen constituent as described above, the above-mentioned means cannot be used as a heating method of the fuel cell of internal refining type melting carbonate as it is.

[0008]An object of this invention is to indicate an internal refining type fused carbonate fuel cell from which the problem of the conventional technology produced at the time of starting of the above-mentioned fuel cell was removed, and an operating method for the same, and it enables this to obtain an internal reforming fuel cell usable as an independent source. That is, temperature distribution in a cell can be lessened, an internal reforming fuel cell can be heated easily even in a place without a detached island or other power supplies, and this invention enables it to generate electricity by supplying fuel and an oxidizer after heating.

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MEANS

[Means for Solving the Problem]A main part of an internal refining type fused carbonate fuel cell which has a reforming catalyst in the anode side in order that this invention may attain the above-mentioned purpose, A means to mix and to burn a part and air of use fuel at the time of a power generation start, and a means to supply heating gas after combustion to the anode and/or cathode side are provided, and an internal refining type fused carbonate fuel cell characterized by things is indicated.
[0010]it becomes possible to attain the purpose more by providing further a means refluxed to the means [to mix use fuel and air and to burn this a part of heating gas discharged from a cell proper] side, and a means to supervise battery temperature and to control fuel and the amount of air supply, and an exhaust gas amount inside. This invention is an operating method of an internal refining type fused carbonate fuel cell which generates electricity by supplying a fuel cell directly without reforming further fuel which does not contain hydrogen, such as methane or natural gas, After burning a part and air of this fuel and consuming oxygen in the air at the time of a power generation start, by supplying heating gas after this combustion to the anode and/or cathode side, An operating method of an internal refining type fused carbonate fuel cell heating a fuel cell body to a temperature suitable for operation is also indicated.
[0011]Mode ***** with making it reflux this a part of heating gas discharged from a cell proper to the means [to mix and to burn use fuel and air] side, and more preferred performing fuel with some fuel and air further under an air content smaller than an air content required for oxidation reaction of this fuel.

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OPERATION

[Function]That is, this invention is mixed with air, burns some fuel, supplies the gas which became high [temperature] to the anode and/or cathode side, makes temperature distribution in a cell uniform, and heats a cell. In this invention, oxygen in the air in the mixed gas of fuel gas and air is altogether consumed in oxidation reaction of fuel.
Therefore, an anode is not oxidized even if it supplies the anode side.
Although it is natural, since refining of the fuel is not carried out, it does not return a cathode.
[0013]It does not interfere, even if combustion of fuel and air may be performed using a combustion furnace and it uses a catalytic combustion device. If it is when recycling and using heating gas, improvement in heating efficiency is expectable. It can heat on condition of hope easily by detecting battery temperature at this time and controlling the amount of recycle gas, fuel, air, and an exhaust gas amount by temperature.
[0014]

[Translation done.]

EXAMPLE

[Example]Hereafter, this invention is explained more to details based on explanation of the example which referred to drawings. Drawing 1 is a lineblock diagram showing only the portion concerning heating of the cell proper at the time of the power generation start of the internal refining type fused carbonate fuel cell by this invention in block diagram. In a figure, 1 is a main part of an internal refining type fused carbonate fuel cell which has a reforming catalyst in the anode side, what was conventionally known in this invention can be used as it is, and detailed explanation about a cell proper is not given.

[0015]The piping 21 for a fuel gas feed port has connected with a cell proper. This piping 21 had the branch pipe 22, and has connected this branch pipe 22 to the catalytic combustion device 2 which adjoined the cell proper 1 and was provided via the flow control valve 32. The piping 23 for introducing air further has connected with the catalytic combustion device 2 via the flow control valve 33, and it has the piping 24 in the combustion-gas-exhaust side.

This piping 24 branches to two forks, and connects one branch pipe 25 to the piping 21 for fuel supply via the flow control valve 35, and the branch pipe 26 of another side is opening it for free passage to the oxidizer feed port side of a cell proper.

The valve 31 is formed in the tee lower stream of the branch pipe 22 in the piping 21 for fuel supply, and the piping 27 for supplying the steam for performing refining of the fuel within a cell proper smoothly downstream further has connected via the valve 37.

[0016]In this example, the branch pipes 42 and 44 are formed, respectively from the anode side discharge piping 41 provided in the gas discharge side of the cell proper 1, and the cathode side discharge piping 43, the biparite branched pipes 42 and 44 are carried out unification 45, and serve as the pipeline 46, and the connection opening is carried out to the air introduction pipe 23. The flow control valves 51 and 53 are formed in the downstream from the tee of the branch pipe of each discharge piping, respectively, and the valve 52 is formed in the branch pipe 42. The recycling blower 3 is formed in the proper part in the channel at the

pipeline 46, and it acts so that the gas in a pipeline may be flowed back to the upstream 33, i.e., air introduction pipe, side.

[0017]At the time of the power generation start, the internal refining type fused carbonate fuel cell by this invention which has such composition is operated as follows. The valve 31 provided in the piping 21 for fuel supply is closed, the flow control valves 32 and 33 are adjusted, the air of the piping 21 side for fuel supply to the specified quantity is introduced from the piping 23 for air introduction, respectively, and the fuel gas of the specified quantity of the natural gas which uses methane as the main ingredients is made to flow in the catalytic combustion device 2. Stirring mixing is carried out within the catalytic combustion device 2, and the fuel and air which flowed burn. Since there is a possibility of containing an oxygen component at the beginning of combustion, about the combustion gas produced by this combustion, the valve 35 is closed and it introduces into the cathode side first, and the valve 35 is opened after fixed time lapse, and the anode side is also supplied. By supply of this combustion gas, a fuel cell body is heated equally, without that whole having an exceptional temperature gradient Therefore, it can heat even to prescribed temperature even at about 650 **, for example. without being accompanied by inconvenience, such as damage to the apparatus by partial thermal expansion etc.

[0018]When a cell proper is heated by even predetermined temperature, the valve 31 is opened, and the operation of a catalytic combustion device is suspended, and it switches to the usual operational status of an internal reforming fuel cell. Since subsequent operational status is completely the same as the operational status in a publicly known internal reforming fuel cell conventionally, explanation is omitted. Although the combustion gas supplied to the fuel cell body is discharged from the piping 41 and 43 for discharge by the side of an anode and a cathode, respectively, those main ingredients of this emission gas are remains methane, carbon dioxide, carbon monoxide, a steam, and nitrogen.

It has a considerable amount of quantity of heat.

Therefore, a cell proper can be more efficiently heated by returning to the upstream again and reusing this emission gas.

[0019]In that case, the flow control valves 51 and 53 provided in the piping 41 and 43 for discharge are adjusted, The valves 52 and 54 provided in each branch pipe 42 and 44 are opened, emission gas is sent into the recycling blower 3 via the pipeline 46, and it returns into the piping 23 for air supply by operation of this Blois at the same time it restricts an exhaust gas amount. It mixes with the air introduced and the returned recycling exhaust gas flows in the catalytic combustion device 2. Within the catalytic combustion device 2, it mixes with the fuel introduced separately and combustion arises.

[0020]Although such control in particular is not illustrated, a piece or two or more temperature detecting means are installed in the predetermined part of a cell proper, The information from

there is supervised and it is very effective to carry out according to this information fuel and the amount of air supply, the discharge of heating gas, and by controlling the flow of the above-mentioned flowing-back gas, etc suitably further. In the case where it carries out with the case where exhaust gas is not flowed back, in the experiment conducted to the same cell proper, the heating rate was 15 ** [h] /and about 30 **/h, respectively, and the time required heating to 650 ** was 44 hours and 22 hours.

[0021]By controlling the quantity of the fuel to introduce and air by this invention suitably, There is nothing that is made to consume all oxygen in the air by oxidation reaction in combustion within a burner and that oxidize an anode even if things can be carried out and it supplies combustion gas to the anode side, and the fuel to be used is also the fuel by which refining is not carried out.

Therefore, it becomes possible to operate without being able to ensure [easily] heating before power generation of a publicly known internal refining type fused carbonate fuel cell conventionally, and making a cell proper also produce what inconvenience from not oxidizing a cathode.

[0022]Although explanation of the above-mentioned example explained what used the catalytic combustion device as a burner, this is only mere illustration and it will be understood easily that arbitrary burners, such as a combustion furnace, can be used similarly.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The lineblock diagram showing only the portion concerning heating of the main part of an internal refining type fused carbonate fuel cell by this invention in block diagram.
[Description of Notations]
1: An internal refining type fused carbonate fuel cell, 2:calalytic combustion device, 3:recycling blower, piping for 21:fuel supply, 23 : piping for air supply

[Translation done.]

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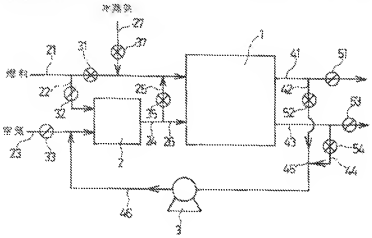
DRAWINGS

[Drawing 1]



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